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ECONOMICAL HOT WATER
HEAT FOR THE HOME

The Ruud

MULTI-COPPER-COIL
HOT WATER
HOUSE HEATER

FOR NATURAL GAS

RUUD MANUFACTURING
COMPANY
PITTSBURG



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From
REFERENCE, PAMPHLET.

ECONOMICAL HOT WATER HEAT

ESPECIALLY SUITABLE FOR

Residences, Apartment Buildings, Terrace Houses,
Hotels, Hospitals, Greenhouses,

And other places where a mild, healthful and
ECONOMICAL heating system is appreciated

General Offices and Factory

(The Ruud Building)



U. S. BRANCHES

Cleveland, 1045 E. Prospect Avenue

Columbus, 346 North High Street

Kansas City, 1406 Main Street

Toledo, 310 Erie Street

Boston, 10 Lincoln Street

Philadelphia, 1938 Market Street

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Louisville, 238 Third Street

Milwaukee, 131 Oneida Street

St. Louis, 1611 Washington Avenue

Dallas, Texas, 368 Commerce Street

Oakland, Cal., 365 Twelfth Street.

European Factory and Depots

Ruud Heisswasser Apparatebau

Schopenstehl 13, Hamburg, Germany

English Branch, 28 Audrey House, Ely Place, Holborn Circus, London, E. C.

The
Ruud
Multi-
Copper-
Coil
Hot Water
House
Heater

FOR
NATURAL GAS
ONLY

Catalogue W
Superseding all previous
Prices and Lists

July 1906
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Ruud
Manufacturing
Company

The Ruud Building
340-342 Second Ave.
Pittsburgh, Pa.
U. S. A.

U. S. Patents

Dec. 30, 1890	June 4, 1901
Sept. 29, 1891	Sept. 10, 1901
Oct. 29, 1895	Feb. 23, 1904
April 7, 1896	May 31, 1904
Sept. 6, 1898	May 16, 1905

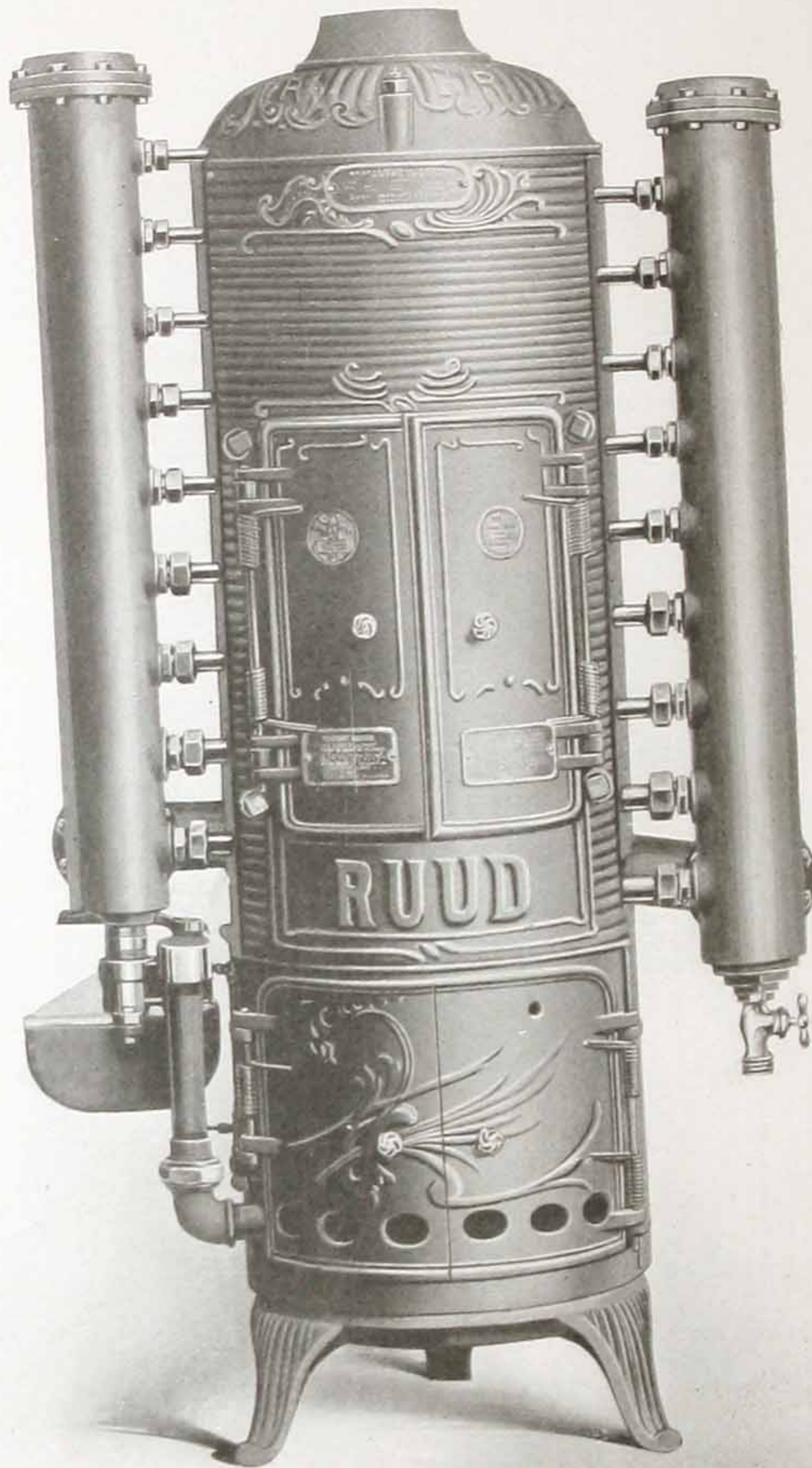
And other Patents Pending

Also protected by British, Canadian,
French, German, Austrian
and Russian Patents

Our Guarantee

We guarantee both workmanship and material for a period of one year from date of installation, and will make good at our own expense any such defects appearing in that time. We warrant our heater to show at least 65% heating efficiency, when properly installed and operated in accordance with directions.

A GUARANTEE THAT
GUARANTEES



Showing the Heater Complete

How to Heat a *House* —to Make a *Home*

Did you ever stop to think that all but a small fraction of the heat generated in the ordinary "hot air" furnaces goes up the chimney, and is wasted? If you pay \$80 for your winter's coal, nearly sixty dollars worth of heat goes to warm all out-of-doors. The other twenty dollars worth of heat *may* be utilized to warm your house. Ask any well-informed heating man if this is not true. With gas as fuel, while the proportionate loss is not quite so great, the same characteristics of the "hot air" faults still exist.

And did you ever think further, that a very great portion of the sickness that occurs in our northern climate during the winter months is caused by uneven temperature in living and sleeping rooms? First hot, then chilly, and often both extremes in the space of a few hours. Colds follow, with serious and often fatal results. This is no exaggeration. If you don't believe us, ask your family physician. The problem, then, that lies before all home-lovers is to secure a heating system that will furnish a reliable, healthful, even heat, at *low cost of fuel*—one that will make of their *house* a *home*.

H a s *T h i s* E v e r B e e n Y o u r E x p e r i e n c e ?

Shake down the furnace, fill it with coal, pull up the damper — then forget all about it until the temperature of your room suddenly seems oppressive and the thermometer registers over 80°, furnace *red hot*. You let down the damper with a bang, pull check wide open, then open outside door and windows to "cool off." Sneeze, colds, doctor bills, and the worst of it is, you're liable to repeat the operation next day.

RESULTS:

Waste of coal or gas.

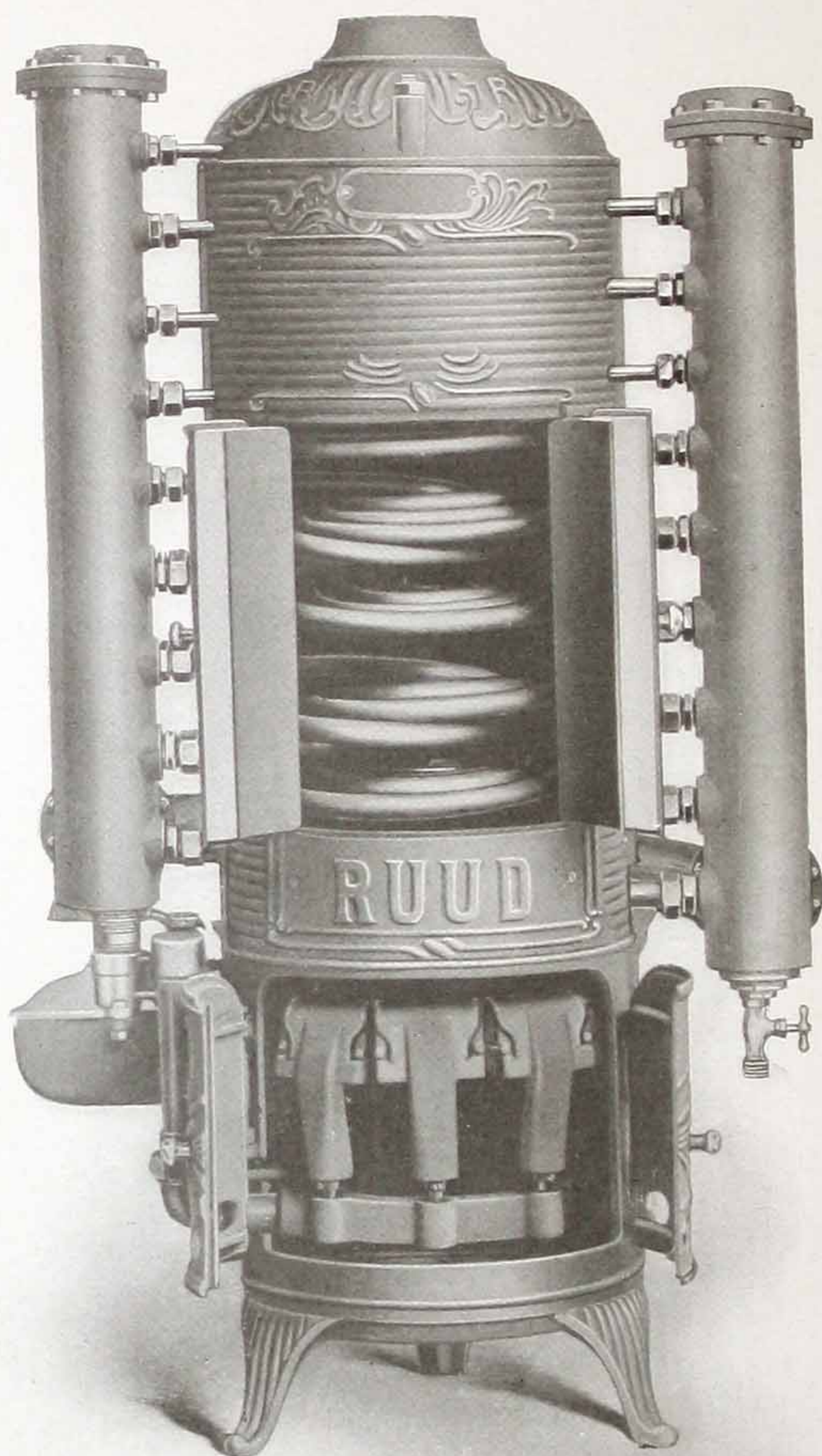
Loss of money.

Moisture in air burned up.

Bad air in circulation.

Unhealthy condition.

General discomfort.



Showing the Multi-Copper-Coil House Heater
Spring doors opened to show simplicity
and accessibility

Also, Has This Been Your Experience?

Fix the furnace for the night, weather moderate. Sudden drop in outside temperature. Wake up in morning half frozen, to dispute who shall go down and start the furnace.

Or, during a cold wave, visit the cellar two or three times during the night in your pajamas, oversleep toward morning, then wake up to find the fire "burned out," house cold, plumbing frozen--water pipes bursted.

RESULTS:—Same as before--only repeated every cold snap.

A Hot Air Furnace Means a Draughty House

A draughty house is the acme of winter discomfort. This is a chronic fault with "hot air" heating systems. Why? Because furnace heat is strictly *convective* heat--it *follows* air currents--and the lighter, hot air currents *cannot* be forced to mix with the colder heavier air currents. Did you ever get up on a step ladder in a furnace-heated room? Did you ever notice that the air near the ceiling was *scorching, stifling hot*? Then did you ever try holding your hand or thermometer down near the floor to feel the *cold draughts* even in the same room.

This will show what we mean--the parched dry furnace air overheats the upper parts of the room and causes cold draughts around the floors.

Plants cannot live in a greenhouse heated with "hot air." That's why hot water heat is always used in greenhouses and conservatories, another proof that hot water is Nature's own heat.

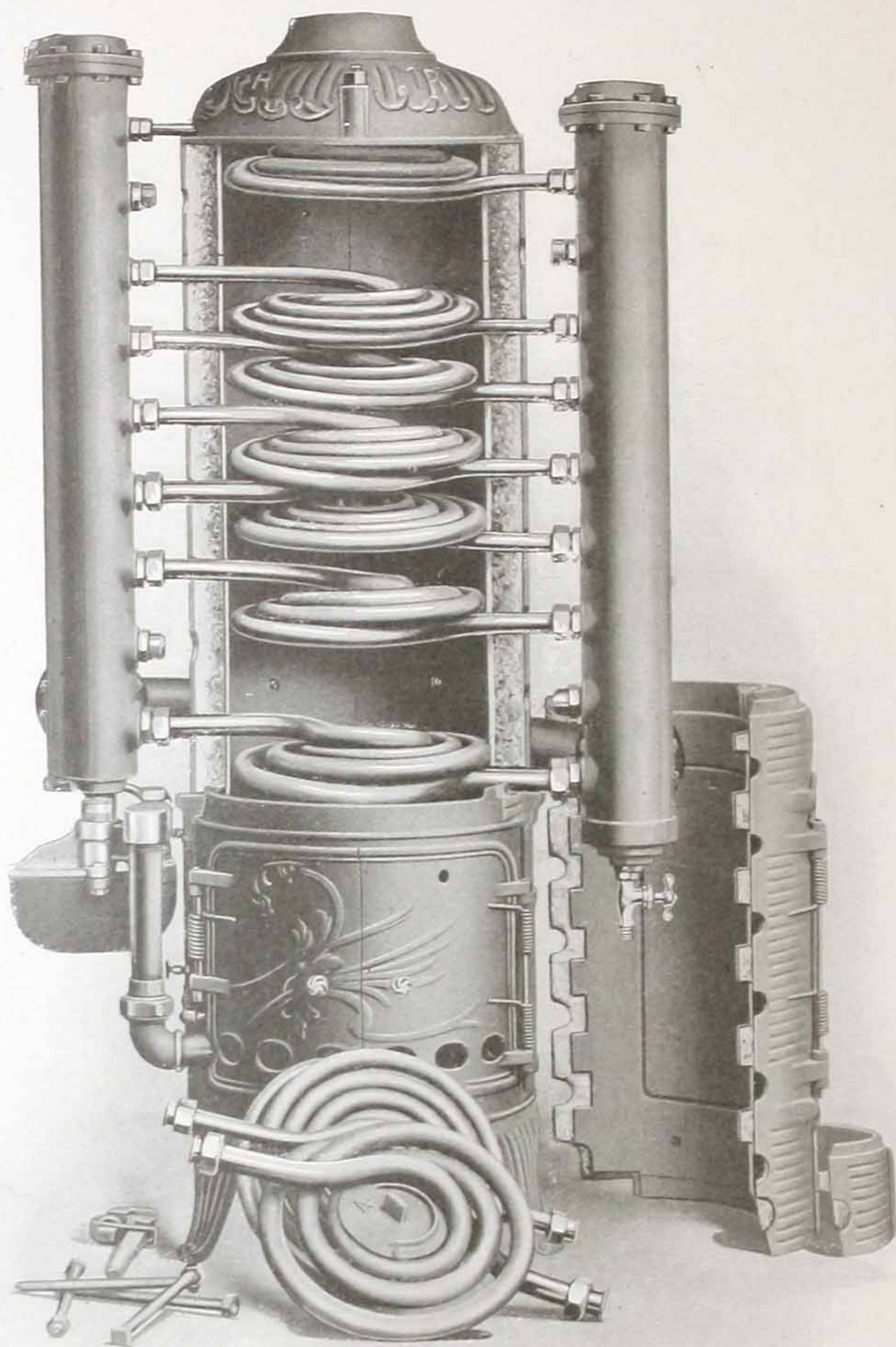
Hot Water Heat

Hot water heat combines the natural laws of heat transmission—by *radiation, conduction, and convection*. Water is the most hygienic and practical means of absorbing, conveying and distributing heat.

*His home, the spot of earth supremely blest,
A dearer, sweeter spot than all the rest.*

—Montgomery.





Showing the Heater with Jacket removed
Note how easily the copper coils can be
detached and removed

Have you ever felt chilly while seated in a "hot air" furnace-heated room and been mystified to find the thermometer registered over 70° Fahr? It was the *devitalized, burned-out* air which failed to properly warm you, together with the draughty air currents always present in furnace-heated houses.

The average life of a furnace is only five to ten years, whereas a hot water heating system will last a *lifetime*, or as long as the house will stand. Consider the economy of operation of the hot water heat over "hot air" systems.

Consider the life-giving properties of the balmy, moist, mild, hot water heat--the health of your family--the saving in doctors' bills.

Consider the absence of dirt and dust, the lessening of the housework, and the saving on carpets, draperies, etc.

Consider the safety features, the absence of danger from overheated furnaces and hot air pipes, etc. Nearly one-half of the fires in residences are caused by furnaces and hot air pipes.

Consider that your Hot Water System will add greatly to the value of your house. The term "Heated by Hot Water" means much when selling or renting.

"Hot Air" Systems are *dirty*

The escaping clouds of ashes and soot and coal dust from hot air furnaces destroy carpets, furniture and curtains. It causes endless cleaning and drudgery. Also, the air drawn in through "intake" ducts carries large quantities of soot and dust up through the registers into the living rooms.

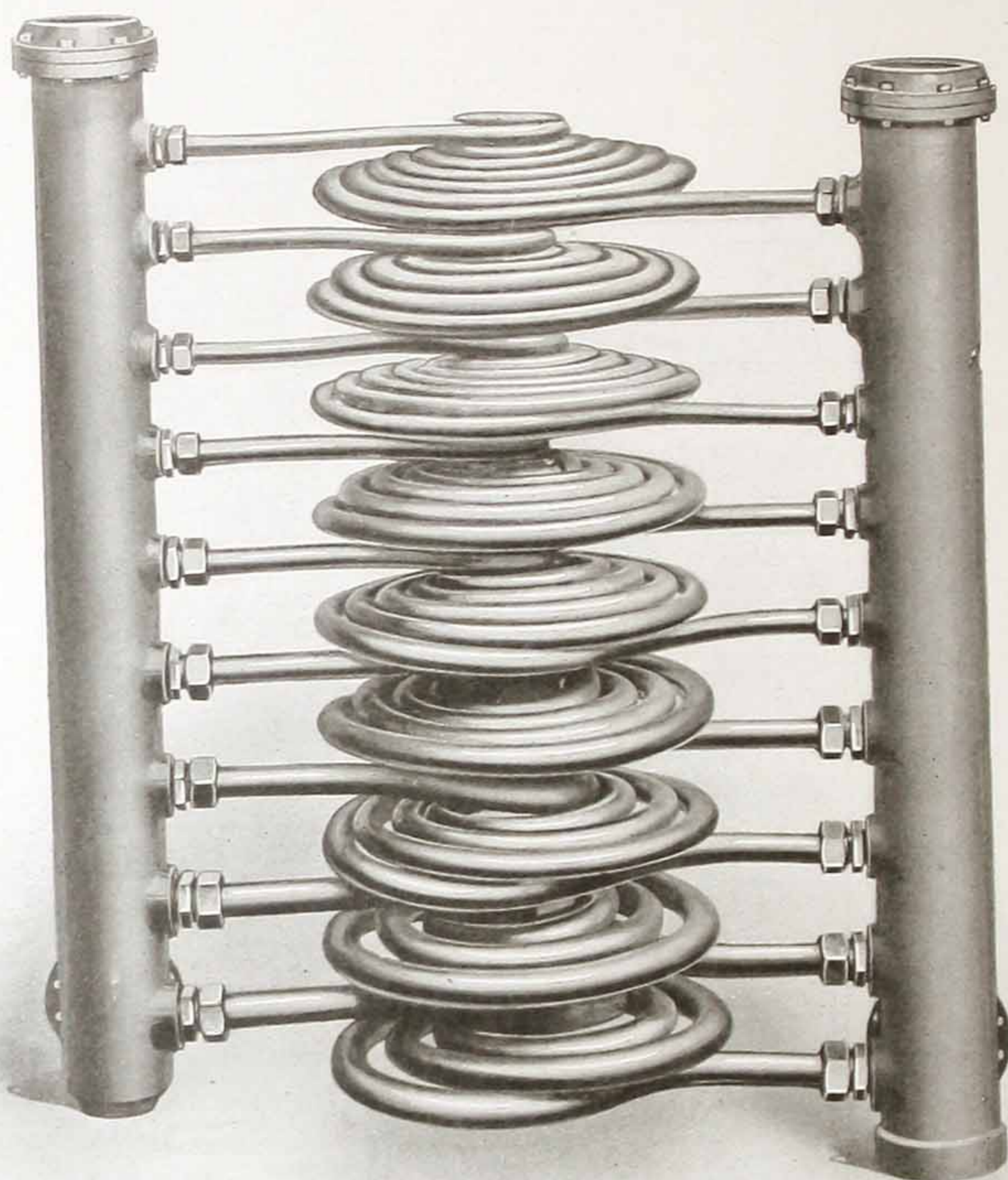
The "gas-front" is a cheerful ornament and gives an impression of home-like comfort. A house should not be without one or more. But a person might as well attempt to warm his house with a hot water bag. "Your back is chilled while your knees scorch."

In spite of the many faults and drawbacks of the "hot air" furnace system, many are used on account of their low *first cost*, especially in houses built *for sale*. In a house built for a *real home*,



*And I'll still stay, to have thee still forget,
Forgetting any other home but this.*

—Shakespeare.



Showing the Multi-Copper-Coil Construction (Front View)
Note the powerful COPPER Heating Surfaces

however, a few hundred dollars saved in first cost must not be allowed to outweigh the very great and important advantages of the Ruud Hot Water House Heating System.

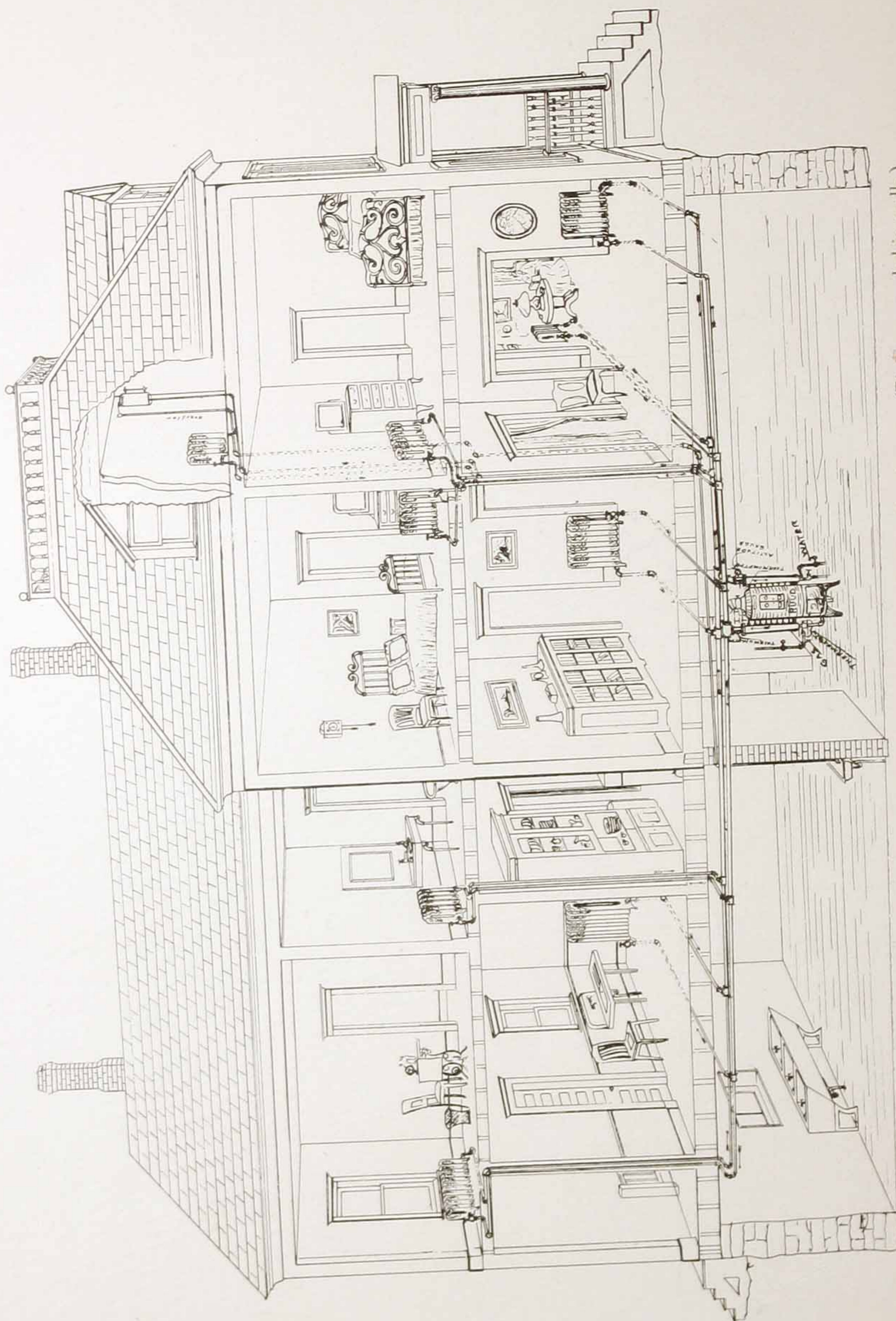
T O B U I L D E R S o f N E W H O M E S

Any builder of a new home who has ever experienced the delightful comfort of hot water heating is sure to insist on this specification in his new plans. Other builders of homes, seeking for the best, are usually informed by their architects of the great benefits of hot water heat. Many persons, however, through a mistaken idea that the heating system is only of secondary importance, change to some "cheap" but ultimately *expensive* system, and put the money saved into extra "trimmings" and "decorations"--"where it will show," as they often say. What a foolish mistake!

Let us repeat--*nothing* is so closely connected with the comfort, the health, the coziness of the home as the heating system. During the seven months of cool and cold winter weather, the average man spends nearly *two-thirds* of his time in the house, the wife and children over *three-fourths* of their time.

Since we introduced our Ruud Instantaneous Automatic Water Heater on the market, ten years ago, for furnishing an ever-ready inexhaustible supply of Hot Water for domestic purposes, hundreds and hundreds of people have urged us to apply these same wonderful and efficient principles to the heating of water for home heating purposes. This demand finally led us to make active experiments and tests in 1903 and 1904. We found that we could build *Copper Coil* Water Heaters that would show wonderful heating powers and high gas efficiency--the only difficulty lay in getting some system for connecting a larger number of *moderate length* coils of *graduated diameters* located in the "heat zone" of heater. This was accomplished in the fall of 1904 by our invention of the patented "manifold" construction as shown in our present "Multi-Copper-Coil" Heater.

*Domestic happiness, thou only bliss of
Paradise that hath survived the Fall!*
—Cowper.



Showing the Ruud Hot Water Heater connected complete in a modern home. (Piping concealed in walls.)
 Note the simplicity of the system—how the water carries and distributes the heat evenly throughout the house.

Upon making efficiency tests we found that this heater showed 70% efficiency--transmitting 70% of the total heat energy of the gas directly to the water to raise its temperature.

We compared this with the 40 to 50% efficiency usually obtained with gas when used in the clumsy, heavy *cast-iron* water heaters generally used, and found that we could save from 30 to 40% of the gas used in ordinary hot water heating systems using gas as fuel. The Ruud Systems which we then put in operation gave most excellent satisfaction *at low cost for gas*.

Do you remember ten or twelve years ago how people tried to put gas burners into their old coal ranges and thus convert them into gas stoves? Who would think of doing this to-day? Yet outside of our "Multi-Copper-Coil" heater, all of the others are simply huge *coal* water heaters *converted* into *gas* water heaters through the addition of a set of make-shift gas burners.

Many people have been putting up with the dirt, ashes, trouble and worry, incident to burning *coal*, simply to avoid the high gas bills necessary to the operation of the crude *cast-iron* water heaters with gas.

Conductivity — Copper 73, Iron 12

The heating surface in the common "water heater" consists of *iron castings* ranging from $\frac{1}{4}$ to $\frac{1}{2}$ -inch in thickness. Many of these surfaces are *vertical* and so exposed that the heat rays from the gas flame can only strike "glancing" blows, and furthermore the heating surfaces usually range from *two to three feet* above the gas flame. This means a tremendous waste of gas, especially in moderate weather, when a great deal of heating is not required, and gas flame should be turned low.

In the Ruud "Multi-Copper-Coil" Heater, the heating surfaces are formed by numerous rings of seamless *Copper Coils* suspended right in the "heat zone" over the intense flame produced by a battery of Ruud gas burners of the



A comfortable home
means graceful hostess-ship

"Bunsen" type. The walls of these copper coils are about 3-64th of an inch in thickness, *are entirely free from any joints or seams*, and are guaranteed to 1000 pounds water pressure. They are practically indestructible, *free from corrosion or rust*, and possess a marvelous power for the transmission of heat to water.

Compare this with the old style cast-iron heaters with their *thick, rough* surfaces to catch sediment and rust on the inside and carbon on the side next flame. Think of their dozens of joints and couplings to leak and get out of order. The Ruud *copper* coils can be *easily cleaned*, are readily *accessible* at all times. Not so with the other heaters.

In the cast-iron construction, the gas flame has to heat *tons of metal* in order to impart heat to the water. Besides this, these heaters hold several *barrels* of water in themselves alone. In the Ruud we simply heat *70 pounds of copper*, and the heater coils only contain about six gallons of water at any one time. This means that with the Ruud system you have about forty to sixty gallons of water *less* to heat. This gives increased economy and efficiency.

Another important consideration, the Ruud is a *sightly* object, takes up little room in the basement and weighs about 600 pounds. The old style heaters are big unsightly affairs, occupy a great deal of space and weigh several tons.

Again, the Ruud is fitted with an automatic *Thermostat* which automatically prevents the water in the system from ever becoming *over-heated* or steam generated. No other system has this feature.

A Few Remarks on the Theory of Hot Water Heating

What causes water to circulate in a heating apparatus?

Water is acknowledged the very best medium for conveying heat, as, volume for volume, it will absorb more heat than any other known substance.

As water is heated it rises to the highest point--to its level. Anyone who has watched the boiling of water in an open kettle has noticed the little globes or "bubbles" of heat rising to the top-

*Nor love thy life, nor hate; but what thou livest
live well, how long or short, permit to Heaven.*

—Milton.

level of the water. Bulk for bulk, water when heated is lighter in weight than when cold. Thus a cubic foot of water at 39° weighs about $62\frac{1}{2}$ pounds, while a cubic foot of water at 180° weighs about $60\frac{1}{2}$ pounds. This difference (or less) in weight brings about the circulation of the water throughout a hot water heating apparatus.

As will be seen in the illustration herewith, the heating surface consists of *hollow copper coils*, which are always full of water. The moment heat is applied, the *copper coils* transmit it to the water. Water is the greatest medium known for absorbing and conveying heat, and the heat globules, answering natural law, rise instantly through the "staggered" cone-shaped coils, thence into the piping and through the hollow radiators beyond. The colder, heavier water falls to the inlets of copper coils to be again heated. As the heat globules rise to the top of the heating system they come in contact with the colder surfaces of the radiators, which absorb the heat from the water and impart it to the atmosphere of the rooms. This cold water, on account of its *greater density*, and therefore greater weight, then drops to the lowest point in the system to be re-heated--again and again.

Remember, the same water is heated over and over again.

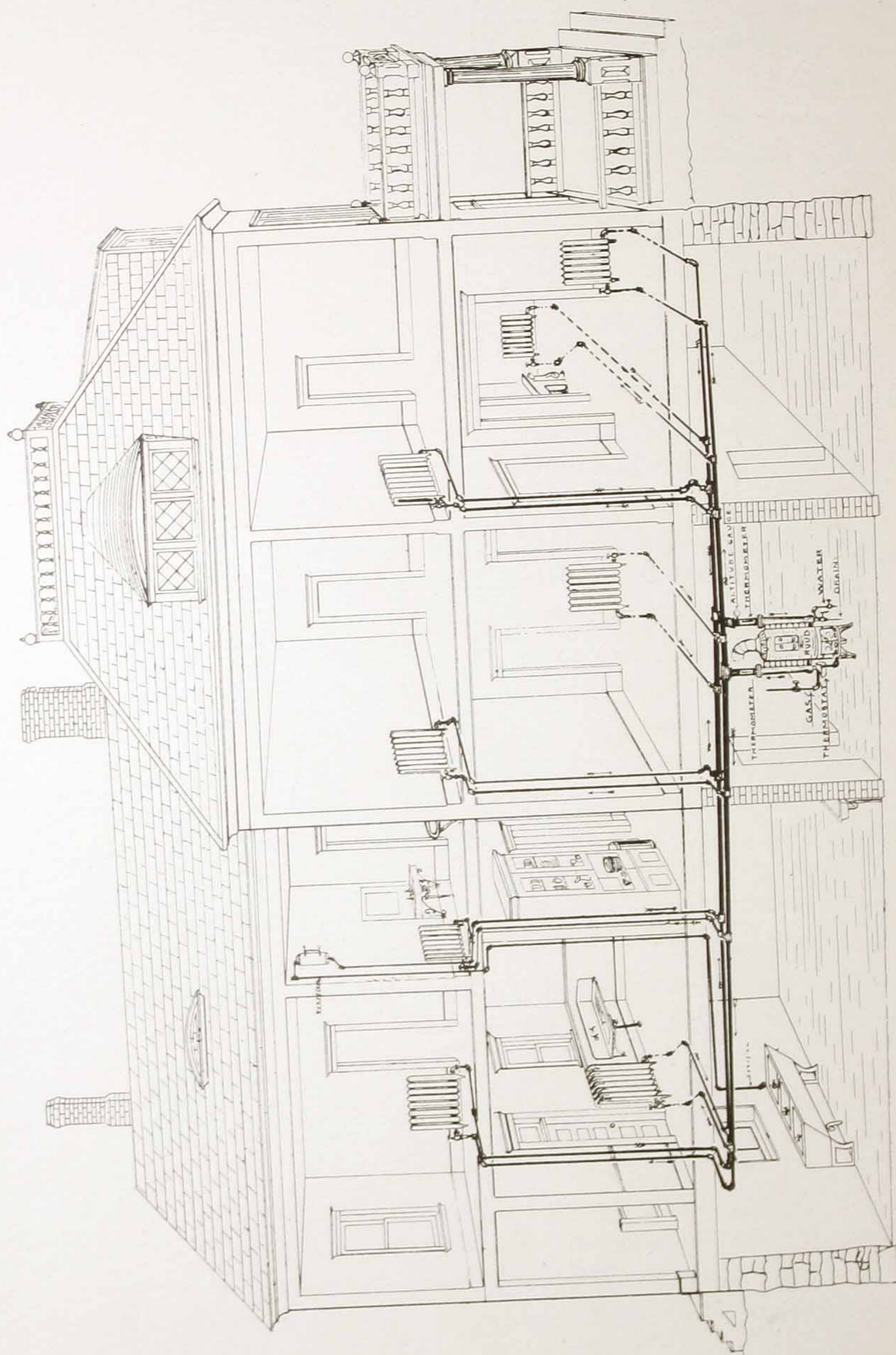
The heated water does not, as is sometimes erroneously supposed, come in contact with the atmosphere of the rooms. The atmosphere of the rooms simply comes in contact with the liberal surfaces of the radiators heated at a low temperature, much lower than the warming surfaces of any other method, such as stoves, hot air furnaces and the like; hence the mild, more healthful quality of hot water heat.

Economical, and All Dirt and Bother Eliminated

Where natural gas is available, there is no other method of house heating so economical, so easily adjusted or cared for as the Ruud Hot Water House Heating System. Simple of construction and operation, with all heating surfaces constructed of pure *seamless*

*For the whole world, without a native home,
Is nothing but a prison of larger room.*

—Cowley.



Showing how easily an *old* house can be equipped with Hot Water heat and the Ruud House Heater.
(Piping exposed.)

copper coils, there is nothing to wear out or need repairs, and no joints to leak. Best of all, however, it is the *most economical* to operate--cheaper than coal.

“T o S a v e T i m e i s t o L e n g t h e n L i f e”

Every advantage of the old-fashioned water heater is retained, with the disadvantages eliminated. With our Ruud System you save over one hour's time every day. No time wasted removing “clinkers,” regulating drafts, shoveling coal, etc. By former methods you spend a great deal of time to get the coal *into* your furnace, then a great deal of time to get it *out*, and, lastly, pay a man to haul the “remains” away.

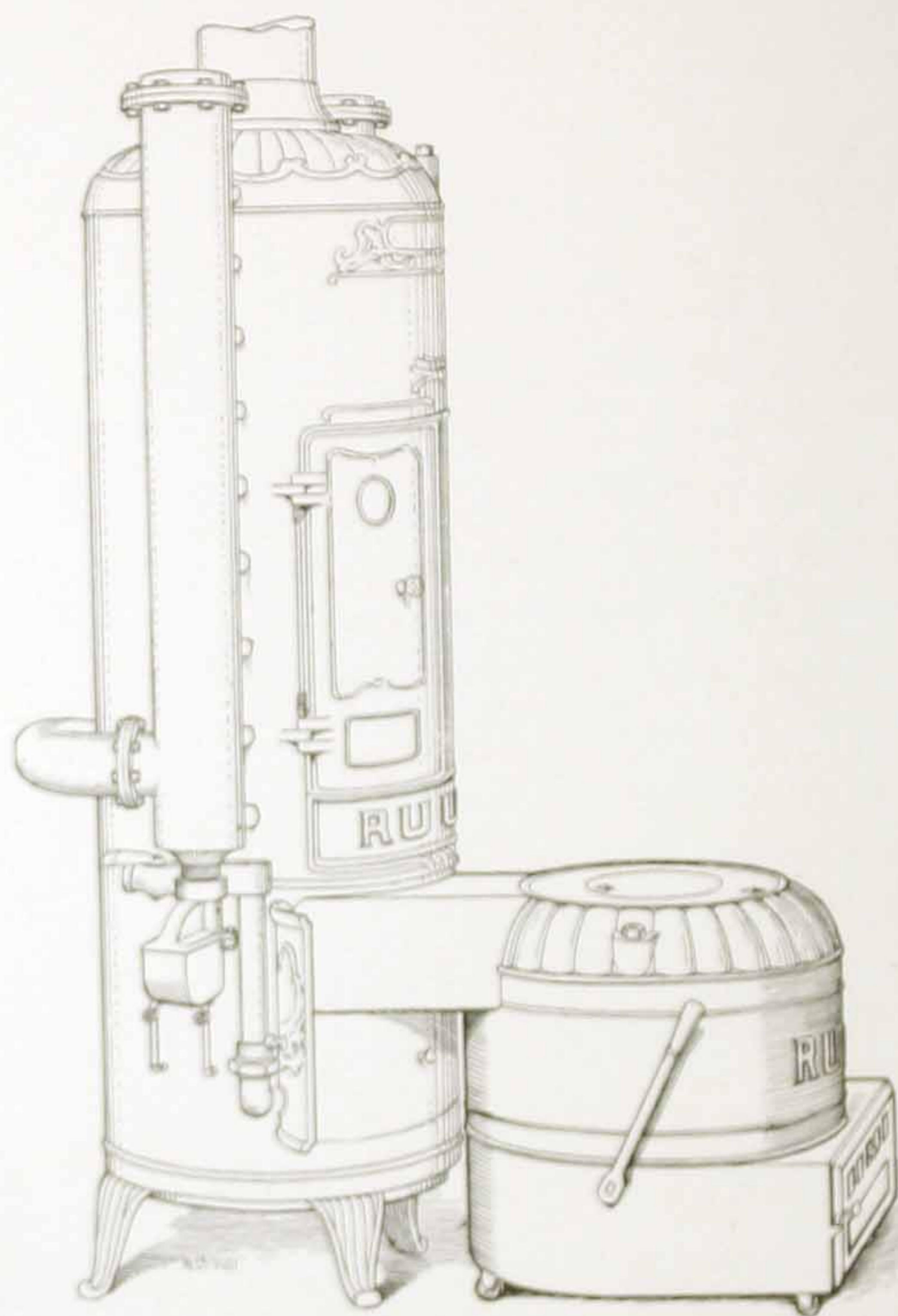
A simple turn of the wrist regulates the fuel supply, and by installing a “house thermostat” the gas regulation is governed *automatically* by the heat of your living room, and the entire operation is purely automatic at all times; the mere turning on or off of one or more radiators automatically regulates the gas at heater.

Now, you'll naturally think that a system which combines all of these great advantages must necessarily cost a “fancy” price, much more than the old style water heaters. Not so; our heaters actually cost less than the others, even though made of *copper* instead of iron, and cost much less to *install*.

A d a p t e d f o r O l d H o u s e s

Where a hot water system is already installed, the Ruud Multi-Copper-Coil Heater can be connected to the piping without interfering with the present *coal* water heater. This gives *two* independent sources of heat, either of which may be used as desired. Many people who connect our heater to their old system, use the “Ruud” during all moderate winter weather, especially in spring and fall, only putting the coal heater in commission during extreme zero weather or “cold snaps,” or during a temporary shortage in the natural gas supply.

*Nor love, nor honor, wealth nor pow'r,
Can give the heart a cheerful hour,
When health is lost. Be timely wise;
With health all taste of pleasure flies.—Gay.*



Showing how the Ruud Coal Heater Attachment can be put into use,
in event of any temporary shortage in the natural gas supply.
(Only hard coal or coke to be used.)

Hot water heat also can be easily installed in old houses without much bother or trouble. This is especially true where a "hot air" system has previously been in use, as most of the hot water pipes can be placed in the old hot-air conductors in walls.

The Ruud Coal Heater Attachment

To meet the objection that might arise in the minds of home-builders, and others, as to how to keep the system in continuous operation at some time when a possible shortage in the natural gas might occur, we designed a coal heater attachment for temporary uses. The Ruud gas burners are independent and easily detached and removed by simply loosening a union. The Ruud Coal Heater Attachment can then be rolled in front of the Multi-Copper-Coil Heater and a *hard coal* fire started. The heat from the hard coal fire passes up through the copper heating coils and the system continues its work until the gas supply is again normal, when the coal heater can be rolled away and the gas burners again swung into heater. Very simple, is it not?

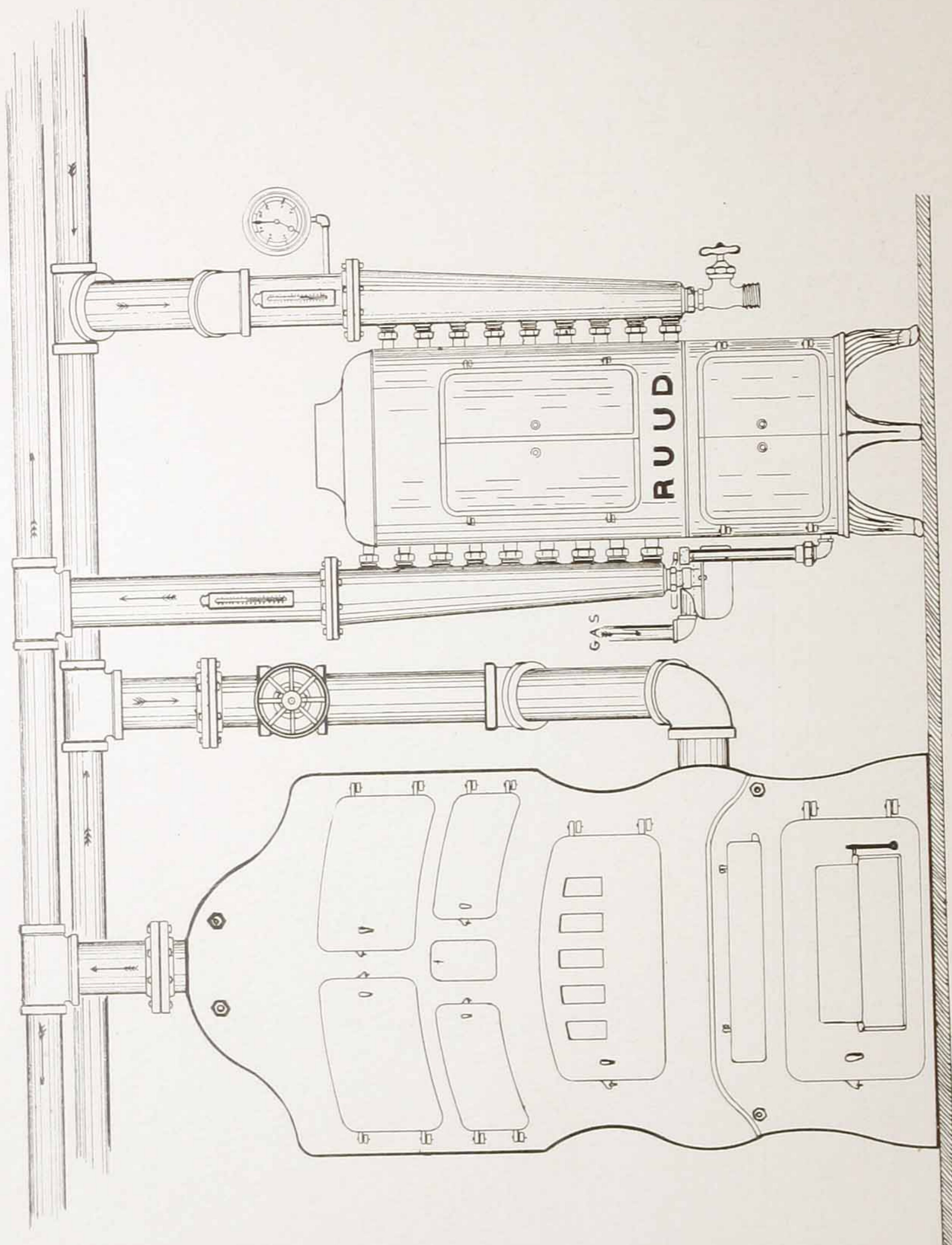
This attachment is low in price, and you thus get every advantage of being provided with two sources of heat.

Also, where artificial gas is available, an independent connection can be made to the service pipe leading to heater, and in times of shortage of the natural gas supply, artificial gas can be burned temporarily. The Ruud Burners are interchangeable for either natural or artificial gas. As an "emergency" supply, artificial gas is very practical and convenient.

Adapted to the "House Thermostat" or Automatic Regulator

By reason of the remarkable ease of control of the Ruud Multi-Copper-Coil System—the prompt response to the *increase* or *decrease* of gas supply, our system works much more perfectly in connection with the automatic regulation effected by thermostat located in living rooms, than is the case with any other hot water system.

*Thus happiness depends, as nature shows,
Less on exterior things than most suppose.*
—Cowper.



Showing how the Ruud Hot Water Heater can be connected to hot water system already having the ordinary *coal* heater installed. Both fuels (gas and coal) can be used together, or either can be used independently of the other.

Instantaneous Heating Effect Quick Results

Every heating engineer will admit the great deficiency of the old-fashioned iron water heaters in regard to getting quick results. It takes such a long time to heat up the huge mass of metal (usually two tons) that in case of a sudden cold snap or blizzard the house gets chilled before the heater can be made to respond. Likewise, in case of a sudden rise in temperature, it takes so long for the unnecessarily large quantity of water to cool down, that your house is *overheated* for several hours, with consequent discomfort and waste of heat energy.

With our *Copper-Coil System*, however, where the heater responds *instantly* to an increase in gas supply, and acts *instantly* in response to a decrease in gas supply to burners, the operation is *flexible* and absolutely under your control. Also, having about fifty gallons *less* of water to heat, you can get quicker heating response, and by the same token, quicker results when you wish to decrease the amount of heat.

What will it Cost to Heat Our House?

If houses of similar size were all of similar construction, similar exposures, same amount of glass surface, same amount of radiator surface, gas of same price and heating qualities, etc., etc., we might be able to give you a very close estimate of cost of heating *your* home.

We can tell you, however, that the people who have installed Ruud Systems are not only pleased with the fine *heating* results, but are delighted with the very economical cost of operation. We know of Ruud Systems in 12-roomed houses, which, throughout the five coldest winter months, averaged only \$12.00 per month for the heating system. Such houses averaged about 760 feet of actual radiator surface, cellar mains not covered.

Our tests have proven that our system will perform the same or better results with from 30 to 40% less gas than consumed in the old-fashioned *cast-iron* water heaters.

The Multi-Copper-Coil and its Advantages

High Heating Efficiency

High Instantaneous Heating Efficiency is obtained by the use of the "Manifold System" of independent, detachable *copper* heating coils, because practically every particle of heat generated by the powerful yet economical gas burners is actually utilized to produce *hot water*—there being absolutely no waste which can possibly be eliminated.

Every coil is constructed in accordance with the well-known "Ruud" principle—that of a "cone" or "staggered" shape.

So-called "heat channels" or flue spaces through the coils are unknown in our Multicoil construction. The avenues for "heat losses" are thus entirely avoided.

The lower coils (nearest the burners) are of *larger diameter* and *shorter length* than the coils in the *middle* and upper part of *heat zone*. We therefore get the great advantage of larger circulation areas and shorter passage ways where the heat is most intense, and *longer* coils of *smaller* diameter in upper portion of heater where it is desirable to retain the circulating water for a longer time.

In our second size heater, for instance, we have the coils graduated from top to bottom of manifolds, as follows:

Three $\frac{3}{4}$ -inch diameter coils	Two $\frac{7}{8}$ -inch diameter coils
Two 1-inch diameter coils	Two $1\frac{1}{8}$ -inch diameter coils

We also secure the great advantage of introducing the cooler "return" water in the *upper* part of *heat zone* (as well as in lower portion) and thus maintain a marked difference between the temperature of the incoming water and the hot gases in upper half of *heat zone*. This gives an increased efficiency and marvelous heating capacity peculiar to our "Multi-Copper-Coil" system alone.

It can, therefore, be seen that every unit of generated heat is used to the best advantage.

The design and general arrangement of the "Ruud" copper coils is such as to eliminate entirely the presence of brazed joints or threaded joints in heat zone.

Consequently, any coil in the system can be easily and quickly disconnected and removed for the purpose of cleaning or replacing.
The repair item is therefore a simple and inexpensive one.

(See illustration, page 8.)

We guarantee 65% heating efficiency, the highest guaranteed efficiency ever given on a gas Hot Water heating system.

Just think, 65% of the total heat energy of the gas is directly transmitted to the water to raise its temperature!

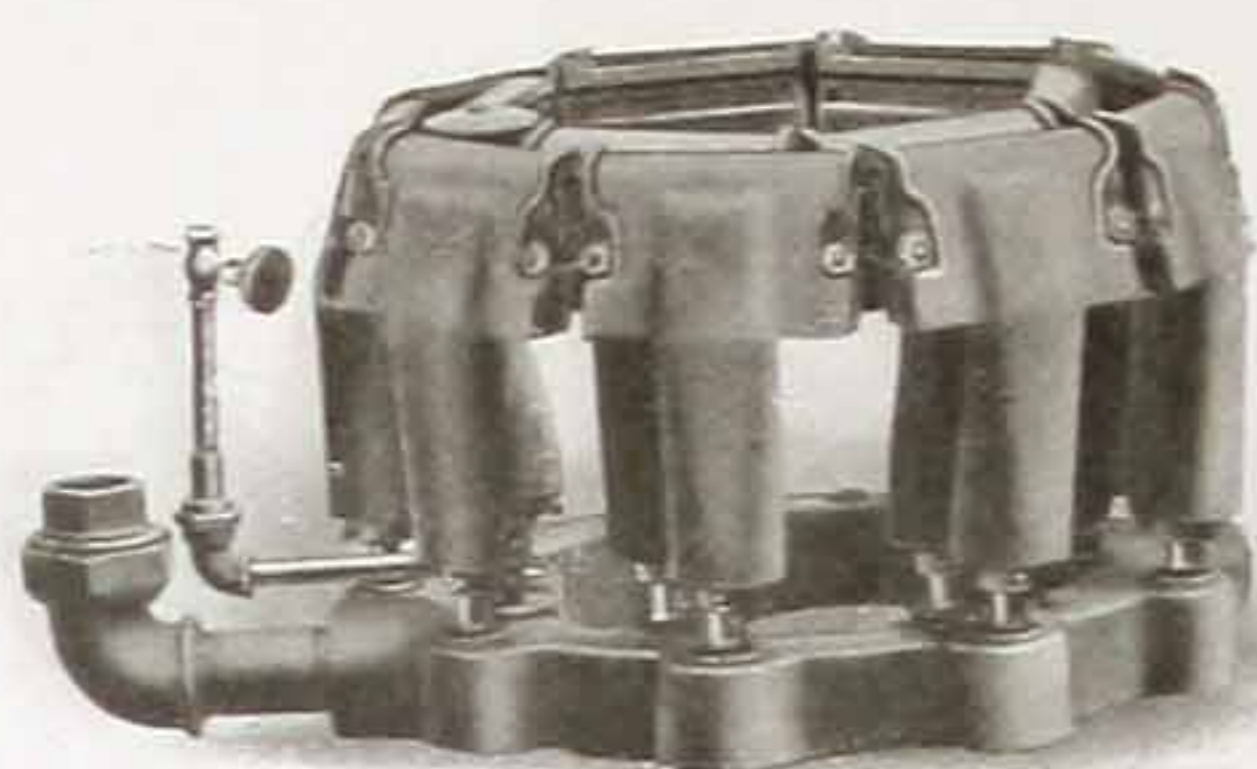
While our factory tests show an efficiency ranging from 68 to 70%, the above guarantee insures a *practical 65% working efficiency.*

Measured from every standpoint—gas efficiency, heating power, perfect automatic control, etc., the Ruud System is in a class by itself. Not the cheapest in first cost, but decidedly the cheapest in the end, many times over.

The multiplicity of *copper* coils, with ample circulation areas and exceptionally large amount of heating surface, in conjunction with the powerful Ruud "Bunsen" gas burners, and the advantages gained through the operation of our Thermostatic Valve, gives a practical hot water heating service with the smallest consumption of gas ever known.

In our system we secure exceedingly *low chimney temperature*, thus proving that *nearly every unit of heat energy is utilized*, and substantiates our claim that the "Ruud" system is the *most economical gas Hot Water system on the market.*

The Ruud features are covered by broad patents, and can be found in no other system on the market.



R u d G a s B u r n e r s

These patented gas burners are remarkable for their intense heating power. The burners are so constructed that the flame is distributed in two rings directly against the

copper coils, without the flame from any one burner impinging upon the adjoining burners. This also avoids over-heating of the cast-iron shell enclosing burners.

Brass set screws and *brass* bolts are used throughout, so that the burners can be removed and easily taken apart after years of service.

J a c k e t o r S h e l l w i t h S e l f - C l o s i n g D o o r s

The jacket body of the heater is made with two heavy cast-iron walls, one within the other. The lower space between the two walls is packed with 85% magnesia insulation, a "Ruud" method of minimizing heat loss through radiation.

Doors provided with self-closing springs, at both upper and lower portions of jacket, render quick and easy access to all parts.

These self-closing doors are an admirable feature in that there can be no chilling of coils by influx of cold air through doors being carelessly left open, and all danger to clothes or person from the gas flames is eliminated.

Expansion and contraction of the iron shell does not interfere in any way with the proper closing of the doors, as owing to their *flexible* nature they adapt themselves to any and all changes in temperature.

The entire front half of the jacket can be quickly and easily removed for the purpose of cleaning and repairs. (See illustration on page 8.)

To Architects, Owners and Heating Contractors

We solicit correspondence and calls on any matters relative to Hot Water Systems. We offer you the benefit of our many years' experience in this work.

We are glad to consult with you at any time and assume all responsibility when our recommendations as to radiation, manner of installing, etc., are followed out.

We do *not* install Ruud Multi-Copper-Coil Hot Water House Heaters ourselves, but furnish these Heaters to competent heating contractors and plumbers doing heating work, to be installed in accordance with our rules, and under our supervision, where possible.

Our House Heater department is in charge of a practical heating engineer, and we make plans and blue prints for house heater installations *free of expense* to owner, architect or heating contractor. Tell us what you want to heat, and we'll tell you all about it.

The "Ruud" Systems are thoroughly guaranteed, have stood the test of time and practical usage, and are therefore worthy of your entire confidence.

Sizes, Capacities and Prices of Ruud Multi-Copper-Coil Hot Water House Heaters

No. of Heater	Height at top of Manifold	Diameter of Heater Shell	Diameter of Outlets	Rating Capacity of Radiation (incl. mains)	Price
600	50½ inches	14 inches	4 inches	600 sq. feet	\$145.
900	53 "	16 "	4½ "	900 "	170.
1200	62 "	19 "	5 "	1200 "	225.
1500	66 "	22 "	6 "	1500 "	280.

Note.—Capacity of radiation includes mains and piping. The amount of actual radiator surface should be about 20% less.

Ruud Manufacturing Company

Makers of

Ruud Multi-Copper-Coil Automatic Storage Systems

Ruud Instantaneous Automatic Water Heaters

The Ruud Building, 340 - 342 Second Avenue
PITTSBURGH, PA.

Cleveland, 1045 E. Prospect Avenue
Columbus, 346 North High Street

Kansas City, 1406 Main Street
Toledo, 310 Erie Street

Heating or Caloric Power of Various Gases (American Meter Co.)

	Aver. Penna. & W. Va.	Aver. Ohio & Ind.	Aver. Kansas	Aver. of Coal Gas	Aver. of Water Gas
B. T. U. per cu. ft.	1145	1095	1100	755	350

Weight and Measure of Water

One cubic foot equals.....	7.48 gallons
One gallon "	8 $\frac{1}{2}$ pounds
231 cubic inches "	1 U. S. gallon
231 " " "	0.1337 cu. ft.

Pressure in Height of Column per sq. in.

2.035 inches of Mercury equals one pound
27.71 " " Water " " "

Size of Mains to be Used for Varying Distances from Heater

Square Ft. Radiator	At Heater Diam.	15 Ft.	30 Ft.	45 Ft.	60 Ft.	75 Ft.
200	2 in.	2 in.	2 $\frac{1}{2}$ in.	2 $\frac{1}{2}$ in.	2 $\frac{1}{2}$ in.	2 $\frac{1}{2}$ in.
300	2 $\frac{1}{2}$ "	2 $\frac{1}{2}$ "	2 $\frac{1}{2}$ "	2 $\frac{1}{2}$ "	3 "	3 "
400	2 $\frac{1}{2}$ "	2 $\frac{1}{2}$ "	3 "	3 "	3 "	3 "
500	3 "	3 "	3 "	3 "	3 "	3 $\frac{1}{2}$ "
600	3 $\frac{1}{2}$ "	3 $\frac{1}{2}$ "	3 $\frac{1}{2}$ "	3 $\frac{1}{2}$ "	3 $\frac{1}{2}$ "	3 $\frac{1}{2}$ "
700	3 $\frac{1}{2}$ "	4 "	4 "	4 "	4 "	4 "
800	4 "	4 "	4 "	4 "	4 "	4 "
900	4 "	4 "	4 $\frac{1}{2}$ "	4 $\frac{1}{2}$ "	4 $\frac{1}{2}$ "	4 $\frac{1}{2}$ "
1000	4 $\frac{1}{2}$ "	4 $\frac{1}{2}$ "	4 $\frac{1}{2}$ "	4 $\frac{1}{2}$ "	4 $\frac{1}{2}$ "	4 $\frac{1}{2}$ "
1200	4 $\frac{1}{2}$ "	5 "	5 "	5 "	5 "	5 "
1500	5 "	5 "	5 "	6 "	6 "	6 "
2000	6 "	6 "	6 "	6 "	6 "	6 "

Expansion of Wrought Iron Pipe

Temperature of air when pipe is filled	Length of pipe when filled	Length of Pipe when heated to			
		100 degrees	140 degrees	180 degrees	220 degrees
	Ft.	Ft. In.	Ft. In.	Ft. In.	Ft. In.
Zero	100	100 0.81	100 1.135	100 1.297	100 1.52
32 degrees	100	100 0.55	100 0.875	100 1.127	100 1.36
65 degrees	100	100 0.283	100 0.605	100 0.77	100 1.044

SOME INTERESTING TABLES RELATIVE TO PIPES, Etc.

Nominal Inside Diameter	Actual Outside Diameter	Actual Inside Diameter	Internal Circumference	External Circumference	Length of pipe per square foot outside surface	Internal Area	Length of pipe in feet to contain 1 gallon water	U.S. gallon per foot of pipe	Weight of pipe per lineal ft.	Weight of water per lineal foot of pipe	No. of threads per inch	Length of perfect Thread
INCHES	INCHES	INCHES	INCHES	INCHES	FEET	SQ. INS.	FEET	GALLON	POUNDS	POUNDS	NO.	INCHES
$\frac{1}{8}$	.405	.270	.848	1.272	9.434	.057	337.7	.0029	.24	.024	27	.19
$\frac{1}{4}$	.540	.364	1.144	1.696	7.075	.104	183.48	.0054	.42	.045	18	.29
$\frac{3}{8}$	.675	.493	1.552	2.121	5.658	.191	100.78	.0099	.56	.083	18	.30
$\frac{1}{2}$	.840	.622	1.957	2.639	4.547	.304	63.32	.0158	.84	.132	14	.39
$\frac{3}{4}$	1.050	.824	2.589	3.299	3.638	.533	36.11	.0277	1.12	.231	14	.40
1	1.315	1.048	3.292	4.131	2.904	.861	22.35	.0447	1.67	.373	11½	.51
1¼	1.660	1.380	4.335	5.215	2.301	1.496	12.91	.0777	2.24	.648	11½	.54
1½	1.900	1.610	5.058	5.969	2.010	2.036	9.45	.1058	2.68	.882	11½	.55
2	2.375	2.067	6.431	7.461	1.608	3.356	5.73	.1743	3.61	1.453	11½	.58
2½	2.875	2.468	7.753	9.032	1.329	4.780	4.02	.2483	5.74	2.070	8	.89
3	3.500	3.067	9.635	10.996	1.091	7.383	2.6	.3835	7.54	3.197	8	.95
3½	4.000	3.548	11.146	12.566	.955	9.887	1.94	.5136	9.00	4.291	8	1.00
4	4.500	4.026	12.648	14.137	.849	12.730	1.51	.6613	10.66	5.512	8	1.05
4½	5.000	4.508	14.162	15.708	.764	15.961	1.2	.829	12.34	6.910	8	1.10
5	5.563	5.045	15.849	17.475	.687	19.986	.96	1.038	14.50	8.652	8	1.16
6	6.625	6.065	19.054	20.813	.577	28.890	.66	1.500	18.76	12.503	8	1.26

